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ANATOMY

The anatomy of the human body is so complicated that only a small proportion of professional anatomists are thoroughly conversant with every detail of the human body. A working knowledge of human anatomy, is however, indispensable to the scientist, and the student will find that after he has mastered these pages he is able to converse with authority concerning this most wonderfully efficient machine called **Man**.

The word **Anatomy** is derived from Greek words which mean to cut through, but the term is used to describe the structure of organized bodies. In this Brochure we will study **Human Anatomy**. The student need not memorize each bone, vessel, nerve, etc. in the body, although the more extensive is his knowledge, the better he will find himself equipped for his future profession. Human anatomy is divided into the following branches.

Osteology, or the study of the bones.

Syndesmology, or the study of the joints.

Myology, or the study of the muscles.

Angiology, or the study of the blood and lymph vessels.

Neurology, or the study of the nerves.

Splanchnology, or the study of the **Viscera** or internal organs.

Adenology, or the study of the glands.

Dermatology, or the study of the skin.

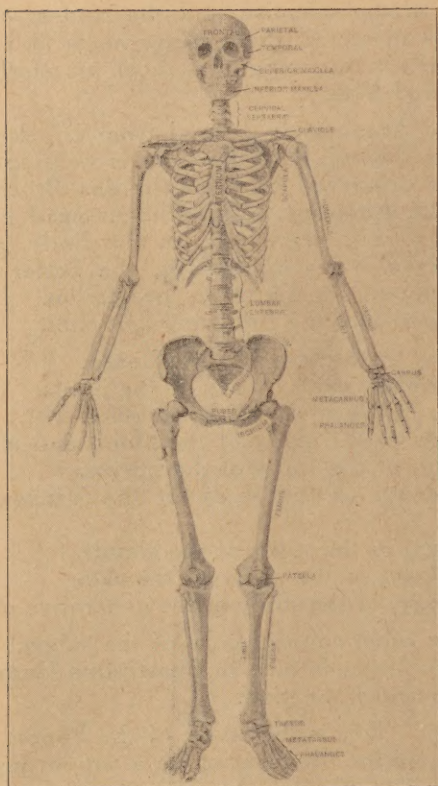
Genesiology, or the study of the generative organs.

There are other sub-divisions of the subject of anatomy, but these are the main ones in **Descriptive Human Anatomy** which we are now studying.

Osteology. This is the study of the bones. In the case of large organisms, there must be a supporting framework of some kind to protect the delicate organs and to bind together the soft tissues into a shapely whole. In the case of the human body this framework is present in the form of a skeleton.

There are 206 bones in the human body and these are classified as follows:

1. The long medullated bones. (90)
2. The short medullated bones. (30)



3. The flat cancellous bones. (38)
4. The irregular cancellous bones. (39)
5. The unclassified bones. (9)

Long Medullated Bones. These bones have a medullary canal passing through them, that is a canal passing through their center from end to end which is filled with marrow. These bones act principally as levers and examples are seen in the radius, ulnar, femur, etc.

Short Medullated Bones. These bones also have a medullary canal passing through them. They include the 14 bones of the ankle and the 16 bones of the wrist.

Flat Cancellous Bones. These bones are characterized by being made up of two layers of dense bony tissue which are separated from each other by a layer of less compact or dense bony tissue. The function of these bones is to protect the delicate internal organs or viscera from injury. They include the bones of the skull which protect the brain and the pelvic bones which protect the delicate pelvic organs.

Irregular Cancellous Bones. These include the vertebra, nasal bones, etc. They furnish support to the body and also assist in forming protective cavities, such as the spinal canal, the nasal cavity, etc.

Unclassified Bones. These bones consist of the two **Patella** or kneecaps, one **Hyoid** or tongue bone which is not attached to the skeleton, and the bones of the middle ear, which occur in pairs, that is there is a similar bone in each ear. They are the malleus or hammer bone, the incus or anvil bone and the stapes or stirrup bone.

Composition of Bone. About one-third of bone consists of organic animal matter, composed of gelatin, blood and lymph vessels, and fat. The remaining two-thirds consists of inorganic mineral matter, which is principally calcium carbonate and phosphate, calcium fluoride, magnesium phosphate, sodium phosphate and sodium chloride. There is a larger proportion of organic matter to the mineral matter present in young bones than there is in the bones of elderly persons who have a relatively large amount of mineral matter in their bones and whose bones for this reason break readily.

Structure of Bone. The bones consist of a dense outer layer and an inner spongy layer. In the case of the medullated bones this spongy substance has a canal running through it which is termed the **Medullary Canal**. This medullary canal contains the bone-marrow. The bone is surrounded, except at the ends where it joins other bones with a glistening white membrane called the **Periosteum**. The medullary canal of the long bones is also lined with a similar membrane called the **Endosteum**.

Bone Marrow. This is a substance found in the medullary canal of the long bones. In young bones it is a sticky transparent fluid which contains no fat, but as the person grows older, the marrow becomes yellow and contains fats and other substances. This marrow is found in the medullary canal of the bones and in other canals which run parallel to the medullary canal. The red blood cells are formed in the bone marrow.

Vessels in Bones. Arteries and veins are found in all bones and some authorities claim that lymph vessels are also present. As the blood is necessary to nourish all of the tissues of the body, the bony tissue has a good blood supply, the periosteum is especially rich in its blood supply.

The Skull and Bones of the Head. The skull consists of flat curved bones surrounding a central cavity in which rests the brain. This presents a wonderful case of a delicate structure of the body protected by a more sturdy structure which can withstand more severe treatment. The curved shape of the skull bones is the most resistant form which they could have and it requires great pressure or a very forcible blow to injure the brain, protected as it is by this bony case. The skull and face are composed of the following bones,

- 1 Frontal.
- 2 Parietal.
- 1 Occipital.
- 2 Temporal.
- 1 Sphenoid.
- 1 Ethmoid.
- 2 Nasal.
- 2 Maxillae or upper jaw bones.
- 2 Lachrymal bones.
- 2 Inferior turbinate bones.

- 1 Vomer bone.
- 1 Mandible or inferior maxillary or lower jaw bone.
- 2 Malar or cheek bones.
- 2 Palate bones.

These bones of the face and skull number 22 in all.

The Bones of the Trunk. These number 53 and are distributed as follows:

- 24 Vertebra.
 - 7 Cervical or neck vertebra.
 - 12 Thoracic or chest vertebra.
 - 5 Lumbar or abdominal vertebra.
- 25 Ribs.
 - 7 Pair of true ribs.
 - 3 Pair of false ribs.
 - 2 Pair of floating ribs.
 - 1 Sternum or breast bone.

The ribs together with the sternum and spinal column protect the abdominal and thoracic organs together with the spinal cord. They form the limiting walls of the thoracic and abdominal cavities.

The Spine, spinal column, vertebral column or backbone is composed of a number of separate bones placed one on top of the other and they are called vertebra because of the fact that they have a limited motion on each other. The spine lines in the center of the back, trunk and neck. The bones of the spine are arranged in groups which are classified accordingly as to the part of the body in which they lie. Thus those in the neck are called the cervical vertebra. Those in the upper part of the back are called the thoracic vertebra, and those in the lower part of the back are called the lumbar vertebra. Those in a group which is still lower are termed the sacral vertebra and those situated at the end of the spinal column and which are fused together are termed the tail, caudal, or coccygeal. The vertebra are all irregular shaped bones but they have some characteristics in common. Thus they all have a central canal through which passes the spinal cord, and each has a projection called the spinal process.

The ribs which are 24 in number consist of bone and also of cartilage. This cartilage unites the ends of the ribs to the breast bone, thus giving elasticity to the chest wall.

It will readily be seen what a convenient arrangement this is as a heavy blow on the chest is taken up by these elastic cartilages and absorbed, while if the chest wall were immobile, a heavy blow would be certain to result in some of the bones being broken thus injuring the organism. In aged persons this cartilage ossifies, that is, lime salts are deposited in it and it hardens and becomes brittle. In fact it is converted into bone.

The Pelvis. The pelvis is made up of 4 bones, the **Sacrum**, **Coccyx**, and the two **Innminate** or unnamed bones. The pelvis protects the abdominal organs and furnishes a support for the organs and protects delicate pelvic organs from injury. The pelvic, thoracic and vertebral bones number 53 in all.

The Bones of the Upper Limbs. There are 32 bones in each upper limb distributed as follows: The shoulder has two, the **Clavicle** or collar bones and the **Scapula** or shoulder bones. The upper arm has one, the **Humerus**. The lower arm has two, the **Radius** and the **Ulna**. The hand has 27, 8 **Carpal** or wrist bones, 5 **Metacarpal** bones or bones of the hand proper, and 14 phalanges or finger bones.

The Bones of the Lower Limbs. There are 29 bones in each lower limb and they are distributed as follows: The upper leg has one, the **Femur**. The lower leg has two, the **Tibia** and the **Fibula**. The foot has 26, 7 **Tarsal** or ankle bones, 5 **Metatarsal** or foot bones proper, and 14 phalanges or bones of the toes.

Besides the above named bones there are two **Patella**, or kneecaps. One **Hyoid** or tongue bone which does not articulate with the skeleton proper. Six bones of the middle ear, namely, one **Malleus**, one **Incus**, and one **Stapes** in each ear. The teeth are not considered bone proper.

The student should frequently consult the diagrams of the skeleton while studying this section as he will thus be enabled to get them firmly fixed in his mind.

If there are any points in the preceding section which are not perfectly clear, the student should write to the College at this time for information on them. You are given **Individual Instruction** and are requested to ask questions.

SYNDESMOLOGY.

Under Syndesmology we study the anatomy of the joints or **Articulations**. An articulation or joint is a connection between two bones and articulations are divided into three main classes as follows:

Synarthrosis or immovable joints.

Amphiarthrosis or joints which have a limited motion.

Diarthrosis or joints which are freely movable.

The following are examples of each of these classes of joints. **Synarthrosis**, the articulations of the bones of the skull by **Suture**. **Diarthrosis**, the articulations of the wrist, shoulder, elbow. **Amphiarthrosis**, the articulations between the bodies of the vertebra.

In an articulation or joint we find the following structures:

1. The articulate portions of the bones which form the joint and which are denser and more compact than the rest of the bone.

2. Cartilage, this structure has no blood supply and is divided into 4 varieties. **Articular** cartilage which covers the ends of the bones in the joint. **Interarticular**, cartilage which is situated between the ends of the bones. **Costal** when it forms part of the skeleton. **Membraniform**, when it is in the form of a thin membrane.

3. Fibro-cartilage occurs in joints and in grooves in bones. It may separate a joint, bind the bones together, deepen a cavity between the joints, or line a groove in the bone.

4. Ligaments. These are tough bands of white tissue which connect bones or support the internal organs or **Viscera**.

5. Synovial membrane. This is a membrane which lines the joints and which secretes a whitish viscid fluid which lubricates the joints. This fluid is called the **Synovial Fluid**.

MYOLOGY.

This subject treats of the muscles and fascia. The muscles are the organs of locomotion and movement and consist of bundles of reddish fibres which under the proper stimulation or irritation have the power of shortening themselves, this power is called **Contractility**. They consist of

75% of water, 20% of proteids, 2% of fats, 1% of nitrogenous extractive matter and carbohydrates, and 2% of salts which are mainly potassium carbonate and phosphate.

There are two main classes of muscles; the **Voluntary** or striped muscles and the **Involuntary** or unstriped muscles. The movements of the voluntary muscles are controlled by the will and are exemplified in the movements of the leg, arm, etc. The involuntary muscles are not under control of the will and are found in the stomach, intestines, etc.

Voluntary muscle fibres are constructed as follows: Small bundles of fibres called **Fasciculi** are enclosed in a delicate membrane called the **Perimysium**. The fibres within the perimysium are called the **Sarcostyles** and are connected together by a delicate connective tissue called the **Endomysium**. The fasciculi are arranged together into muscle fibres from $1/600$ to $1/200$ of an inch in diameter. The **Sarcollemma** is the sheath which surrounds the sarcostyles.

Involuntary Muscle Fibres are composed of contractile spindle-shaped fibre cells about $1/450$ of an inch long and $1/4000$ of an inch broad. They are gathered into bundles or bands and are held together by a cement-like substance. These bundles are connected together into larger bundles or flattened bands held together by connective tissue.

Tendons or Aponeuroses. Tendons are cords or bands of white fibrous tissue that have a glistening appearance. They have a few blood vessels but the smaller ones have no nerve supply. They connect a muscle with the structure that the muscle moves. An aponeurose is a fibrous membrane which has the same appearance and structure and serves the same purpose as a tendon.

Fascia. These are flat structures like a membrane, which cover the soft structures of the body. The superficial fascia or **Suncutaneous Tela** consists of two layers, the fatty layer which is closely applied to the **Derma Vera** or true skin and which covers practically the entire body, except on the eyelids, the scrotum and the penis. This layer contains a great deal of fat. The deep layer of the superficial fascia is a layer of fibro-muscular substances which envelops the entire pelvis, abdomen and thorax. On the sides of the neck and upper thorax it is composed almost entirely of muscle and is called the **Platysma**. On the scrotum it partakes of the same character and is here called the **Dartos**.

The deep fascia or **Panniculus Carnosus** is constructed much like an aponeurose and is dense, fibrous and non-elastic. It covers the muscles and attaches some of them to adjacent structures. It binds all of the soft parts of the body into a shapely mass.

Attachments of Muscles. The muscles are attached to the periosteum of the bone and to the perichondrium of the cartilage which they affect. They are also attached to ligaments.

ANGIOLOGY.

This branch of anatomy takes up the study of the vessels which contain and carry the lymph and the blood. The heart will also be considered here as it is part of the vascular system.

The heart is that organ of the circulatory system which serves as a central pump to drive the blood throughout the body. It contains four cavities, one right and one left auricle and one right and one left ventricle. The heart is a hollow, cone-shaped muscular organ which is placed in the thoracic cavity between the lungs with its base upward. In the adult it is about the size of the person's closed fist and weighs from 8 to 12 ounces. A muscular partition separates the auricles and ventricles from each other thus forming four cavities. The muscular wall of the heart consists of striped involuntary muscle fibre, and is called the **Myocardium**. This is the exception as involuntary muscle fibre is, in other cases, unstriped. The interior surfaces of the cavities of the heart are lined by the **Endocardium** which consists of a single layer of endothelial cells and which is continuous with the endothelial lining of the blood vessels which have access to the heart. The endocardium also forms valves between the auricles and the ventricles. It is very smooth in order that the blood may flow over it without obstruction.

The heart is placed in a closed sac called the **Pericardium**. This pericardium consists of two coats, an outer fibrous one and an inner serous one. This inner serous coat has two layers, one called the parietal layer which is attached to the fibrous coat and which is reflected on to the heart as a visceral layer. This last visceral layer is closely applied to the heart and it is this which gives to a freshly removed heart its glossy appearance. We thus have two

serous layers in contact and these serous layers secrete a thin fluid which serves to lubricate them. Normally this fluid amounts to much less than an ounce.

The Cavities of the Heart. The right auricle is a little larger than the left and its walls are thinner. It holds about two ounces of blood. The blood is received into the right auricle from the two vena cava and is forced by the con- tricuspid opening which is guarded by the tricuspid valve which prevents the blood from flowing back into the auricle. The right ventricle is triangular in form and can hold about three ounces of blood. It receives the blood from the right auricle through the tricuspid opening and when the heart contracts the ventricle forces this blood into the pulmo- nary artery. This pulmonary artery is guarded by a semi- lunar valve which prevents the backward flow of the blood into the ventricle. The pulmonary artery conducts the blood to the lungs where it is oxygenated and is then brought to the left auricle by means of the pulmonary veins which have no valves guarding their openings. The left auricle is smaller than the right auricle but it has thicker walls. The blood on being received into the left auricle is forced by the contraction of the heart into the left ventricle through the bicuspid or mitral valve which prevents the blood from returning to the auricle and when the heart contracts the ventricle forces the blood into the **Aorta**, which is the largest artery of the body and from which is is distributed to the various parts of the body. At the same time that the heart contracts the arteries also contract thus assisting in maintaining the circulation of the blood through- out the body.

Valves of the Heart. The valves are reduplications or folds of the endothelial lining of the heart. Attached to the edges of these valves are structures called **Chorda Tendinea**, these are fine white cords and are attached at their other end to the **Papillary Muscle**. This papillary muscle is in turn attached to the **Columnae Carnae** which are columns on the wall of the heart. They are part of the myocardium. The columnae carnae are covered by en- dothelium the same as the rest of the interior of the heart.

Arteries. These are the cylindrical elastic tubes which carry the blood from the heart to all of the different parts of the body. The aorta and its branches which carry the blood throughout the body and the veins which return this

blood to the heart are termed the **Systemic Circulation**.

The pulmonary arteries which carry the blood to the lungs and the pulmonary veins which together with the connecting capillaries return the oxygenated blood to the heart are termed the **Pulmonary Circulation**.

With the exception of the pulmonary artery which carries impure blood from the heart to the lungs and the pulmonary veins which return pure blood to the heart: the veins carry **impure blood** and the arteries carry **pure blood**. An artery is essentially a vessel which carries blood **from** the heart while a vein carries blood **to** the heart. The arteries join together freely throughout the body and this joining together or branching is termed **Anastomosis**. This anastomosis permits the supply of blood to a part even though one of the supplying arteries be severed or blocked, the blood continues to be supplied to the part through the **Anastomosing** branches. This is termed **Colateral Circulation**.

Structure of the Arteries. The arterial tubules are very firm and dense in structure. They consist of three coats which are termed from within, outward respectively, the **Intima** which is the smooth endothelial lining of the arteries and consists of a single layer of endothelial cells; the the **Media** which is the middle coat and which is composed of muscular and elastic tissue; and the **Adventitia** which is the outer coat and which is composed of connective tissue. The larger arteries have small blood vessels running through the media and adventitia and are also supplied with nerves. These small blood vessels within the coats of the arteries are termed the **Vaso Vasorum**.

The Veins. These are the blood vessels which bring the impure blood from the capillaries to the heart. The veins are composed of three layers or coats like the arteries, the internal endothelial lining called the **Intima**, the middle muscular coat called the **Media** and an external coat called the **Adventitia**. This adventitia blends with the surrounding tissue through which the arteries and veins travel. The coats are thinner than the coats of the arteries but are of the same general structure.

There are three main systems of veins and they are termed the **Systemic**, the **Portal** and the **Pulmonary** system. The pulmonary system of veins consists of the pulmonary

veins which collect the blood from the lungs and return it to the heart. These veins number four, two from each lung. The systemic veins return the blood from the general body circulation to the heart. The portal system of veins collects the blood and products of digestion from the digestive organs and carries it to the liver.

The main characteristics of the veins is the presence in them of structures called **Valves** which prevent the backward flow of blood. These valves are formed by reduplications or folds of the endothelial lining or intima. They are semilunar in shape, that is they present the shape of a segment of the moon. The arteries contain no valves but the veins all contain these structures with the exception of the following.

Vena cava, Hepatic vein. Portal vein, Renal vein, Uterine vein, Ovarian vein, Cerebral veins, Spinal veins, Pulmonary veins, Umbilical veins, and the very small veins.

Capillaries. These the the minute tubules or vessels which connect the veins and the arteries. They are composed of a very thin membrane which is really the intima of the blood vessels which they connect. They are about $1/3000$ of an inch in diameter.

LYMPHATIC SYSTEM.

The lymphatic vessels are very thin, delicate and transparent tubes which carry away the lymph from the tissue spaces. These lymphatic vessels are found in every portion of the body which has a blood supply as they drain the lymph from the tissue spaces and this lymph is derived from the blood. The nails, hair, outerlayer of the skin and cartilage have neither a blood supply, blood vessels, nor lymphatic vessels. The larger lymphatic structures have three coats the same as the arteries but the smaller ones have only two, the middle coat being absent. They also like the veins have valves, but these valves are placed much closer together. The lymphatics return the lymph which they have collected to the blood. On the left side this is returned by means of the **Thoracic Duct** which enters the veins at the junction of the sub-clavian and internal jugular veins and on the right side by means of the right lymphatic duct.

The lymphatic vessels of the small intestines which absorb and carry to the blood the products of digestion and which is called **Chyle**, are termed the **Lacteals**.

Lymphatic Glands. These structures are small solid, gland-like bodies which occur at many places along the lymph vessels. They filter the lymph, removing and destroying the solid particles which the lymph may contain, such as bacteria, etc. They must prevent the foreign matter from reaching the blood as the lymph has to pass through a great many of these structures before being returned to the blood. These lymph glands are all named from the position which they occupy. The bronchial glands are located near the bronchi in the lungs, the axillary glands are located near the axilla, etc.

The construction of a lymph gland is as follows: The external coat (adventitia) of the lymph vessels when it reaches a gland, extends over the structure and is here called the capsule of the gland. The entering lymph vessel divide into a number of very small vessels which ramify through out the gland. These vessels consist only of endothelium. The vessels traverse the gland and finally collect into one large vessel which leaves the gland.

The Thoracic Duct. This is the largest lymph vessel and has many valves, it returns the lymph from most of the body to the blood.

NEUROLOGY

There are two distinct substances composing the **nervous system**. The grey matter and the white or fibrous matter. The nervous impressions and impulses originate in the grey matter and are conducted from and to the different parts of the body by the white substance.

The grey substance is composed of nucleated cells which are called **nerve cells** or **Ganglionic Corpuscles**. These nerve cells vary in size and shape and are named according to the number of processes they have as **Unipolar: Bipolar: Multipolar**, etc.

The small projections from the nerve cells are called **Dendrites** or **Protoplasmic Processes** and one of them which is very long and which becomes the **Axis Cylinder** of the nerve fibre is called the **Axone** or **Axis Cylinder Process**.

In the white nerve substance or nerve fibre are two kinds of fibres, the white or medullated fibres and the grey or

non-medullated fibres. The axis cylinder of a nerve cell extends through the center of the medullated fibres and is a direct continuation of the nerve cell.

The axis cylinder is enclosed in a medullary sheath called the white substance of Schwann, this protects the axis cylinder from injury.

These structures are both enclosed in a sheath called the **Neurilemma** or sheath of Schwann. A small bundle of these fibres is called a **Funiculus** and the individual fibres are held together by delicate connective tissue called the **Endoneurium**. The funiculus is enclosed in another connective tissue called the **Perineurium**. Bundles of funiculi are fastened together by another membrane called the **Perineurium** and this collection of funiculi is called a nerve.

The non-medullated, grey or gelatinous nerve fibres of Remak are made up of an axis cylinder enclosed in a nucleated sheath. Most of the sympathetic nerves and some of the cerebro-spinal nerves are of this type.

Ganglia. This is the term applied to small collections of nerve cells which are connected with each other and also with nerves in distant parts. They consist of a collection of nerve cells and nerve fibres and are surrounded by a membranous sheath which is continuous with the perineurium of the nerves, and this sheath sends portions of itself into the interior of this ganglion to support the blood vessels which give the blood supply to the nerves.

Brain. The brain is composed of two distant structures, the **Cerebrum** and the **Cerebellum**. The brain is also divided through the center into a right and a left hemisphere. The Cerebrum is made up of both white and grey matter.

Meninges. There are three membranes or meninges which envelop the brain and the spinal cord. They th from without, inward the **Dura Mater** which is a dense fibrous structure which lines the interior of the skull and which is composed of two layers closely bound together. The **Arachnoid** is the next or middle membrane and consists of a single delicate layer. The **Pia Mater** is the innermost membrane and is well supplied with blood vessels. It is closely applied to the brain.

The spinal cord is a continuation of the brain and is enveloped by continuations of the three membranes which cover the brain. It consists as does the brain of both white and grey matter, the grey being inside of the white.

There are twelve pairs of cranial nerves which leave the brain proper, they are:—

- 1st Nerve (Olfactory)
- 2nd Nerve (Optic)
- 3rd Nerve (Motor)
- 4th Nerve (Trochlear)
- 5th Nerve (Trifacial)
- 6th Nerve (Abducent)
- 7th Nerve (Facial)
- 8th Nerve (Auditory)
- 9th Nerve (Glosso-pharyngeal)
- 10th Nerve (Pneumogastric)
- 11th Nerve (Spinal accessory)
- 12th Nerve (Hypoglossal)

Spinal Nerves. There are 31 pairs of spinal nerves divided for convenience into the following:

- Cervical—8
- Thoracic—12
- Lumbar—5
- Sacral—5
- Sacrococcygeal—1

It is not necessary for the student to learn or memorize these nerves and branches, a general idea of them is all that is required. The nerves as a rule leave the spinal cord just above the corresponding vertebra.

Under Neurology will also be considered the organs of special sense, such as those of the skin, (touch); sight (eye) etc.

DERMATOLOGY

The Skin and Its Modifications: Under this head will be considered the skin together with its modified structures such as the hair, nails and teeth. The skin is composed of two main structures viz:—the **Epidermis**, cuticle or scarf skin: and the **Dermis** or **Corium**, or **Cutis Vera** or true skin which is the inner layer.

Epidermis. This is the outer layer of the skin and consists of five sub-layers, three superficial and two deeper layers none of which have blood or lymph vessels. It is composed of epithelial cells closely adherent together and which on the surface are dry and flattened out but in the middle of the scarf skin they are softer and rounded in

shape and in the deeper portions they are very soft and columnar. The hard, horny outer layer is called the **Stratum Corneum** and is composed of hardened epithelial cells which have no nucleus. Next comes the **Stratum Lucidum** consisting of scaly cells packed closely together. Below is the **Stratum Granulosum** consisting of flat spindle shaped cells which contain a substance called **Eleidin** which is one of the products that occur in the formation of horn. Next is the **Stratum Malpighii** or as it is sometimes called the **Rete Mucosum** and which contains pigment cells, that is, cells which contain pigment or coloring matter. The lower layer of the scarf skin is called the **Stratum Germinativum** or **Basilar Layer** and is composed of columnar epithelium the cells of which are placed endwise on the surface of the true skin but which are separated from this true skin by a homogeneous basement membrane.

The derma or true skin is a very elastic but tough tissue which protects the parts which it covers and performs the functions of secretion and absorption and which is the main seat of the sense of touch. It consists of two layers, the **Papillary Layer** and the **Reticular Layer**. Both layers are well supplied with blood and lymph vessels. The papillary layer lies next to the epidermis and is separated from it by a delicate basement membrane. This layer has very small elevations called **Papillae** about 1/100 of an inch high and which are very numerous. These papillae are arranged in a series of concentric curves where the sense of touch is the greatest. Each papillae contains a sensory nerve ending which in the most sensitive parts is modified into a **Tactile Corpuscle**. The deeper or reticular layer is mostly composed of white fibrous tissue containing yellow elastic fibres and wherever there is hair, some plain muscle fibres. There are also blood and lymph vessels in this layer as well as nerves. The lower part of the reticular layer blends with the underlying tissue which is called the subcutaneous tela and which in most parts of the body contains fat.

Mucous Membrane is a modification of the skin which is found lining the body tubes which have access to the outer air, such as the respiratory tract, the alimentary tract, the urinary tract and the genital tracts. It is soft and velvety and is composed of a variety of types of epithelial cells, in some places ciliated. There are many glands found in

the mucous membrane which secrete a substance called mucous which serves as a protective covering for this surface. Mucous membrane is well supplied with nerves, lymph and blood vessels.

The Nails. These horny structures are modifications of the skin, they occur on each finger and toe. The **Matrix** of the nail is that portion of the derma directly under the nail. The **Lunula** is the white crescent shaped portion at the base of the nail.

Hair. This is also a modified form of the epidermis which has no blood supply. The hairs have three points of interest, the **Root** which rests in a depression of the epidermis, the shaft which is the projecting part of the hair, and the point which is thinnest.

Teeth. These structures are not a part of the skeleton but are derived from the dermoid system of the embryo. In the adult there are 32 teeth, classified as follows: In each jaw there are 2 wisdom, 4 molar, 4 premolars, 2 canines, 4 incisors making 16 teeth in each jaw or 32 in both jaws.

Viscera of the Abdomen. The abdomen is that cavity situated between the chest and the pelvis. It is separated from the chest or thoracic cavity by a membrane called the **Diaphragm**. It is lined by another membrane which is termed the **Peritoneum**. This cavity contains the following organs: Stomach, intestines, liver, kidneys, pancreas, spleen, gall-bladder, and supra-renal glands.

Stomach. This is the principal organ of digestion and is located between the bottom of the esophagus and the upper portion of the small intestine. The end attached to the esophagus is termed the cardiac end and the lower end is termed the pyloric orifice and is guarded by a valve called the pyloric valve. In the walls of the stomach are found a number of glands termed the **Gastric Glands**.

Small Intestine. This portion of the alimentary tract is about 20 feet in length and is divided into three portions for classifications, the **Duodenum** which is the first ten or twelve inches of the tube from the stomach, the **Jejunum** which is the name given to the next $2/5$ or $1/2$ of the rest and the **Ileum** which is the remaining portion.

Large Intestine. This tube extends from the end of the small intestines to the anus. It is only about five feet long

but it is much larger in diameter than the small intestine. It is also divided into three portions, the **Cecum** which is a blind pouch at the commencement of the large intestine; the **Colon** which is the intestine proper; and the **Rectum** which is the term applied to the last eight inches of the large intestine. The anus is the terminal orifice of the large intestine.

Liver. This is the largest gland in the body and weighs from three to four pounds. The liver is composed of numerous lobes and has an especially rich blood supply. The liver cells manufacture bile which is stored in the gall bladder. This bile is used in digestion.

Pancreas. This is also called the sweetbread in animals. It is about $5\frac{1}{2}$ inches long and about $1\frac{1}{2}$ inches broad. It secretes the pancreatic juice which also plays an important part in digestion.

Lungs. These are the main organs of respiration. They are placed in the thoracic cavity, one on each side of the center line. The right lung is larger than the left and has three lobes. The left lung is smaller and has only two lobes. Each lung is divided into **Lobules** each of which contains numbers of air cells or alveoli.

Kidneys. The kidneys are organs which occur one on each side of the spine in the back. Their function is to secrete the urine. They deliver this urine to the bladder by means of structures which are little tubes termed the **Ureters**.

Bladder. This is the reservoir for the urine. It is a sac the walls of which are composed of muscle and membranous tissue. It holds about a pint of fluid when moderately distended. This urine is conducted away from the bladder by means of a tube called the **Urethra**.

GENESIOLOGY

Prostrate Gland. This gland which occurs in the male and is analogous to the womb in the female is shaped somewhat like a horse chestnut and surrounds a portion of the urethra. It lies in front of the rectum and can be felt through that structure. This gland often becomes inflamed in gonorrhea.

The Penis. The penis is composed of erectile tissue. This tissue is distributed throughout the organ. There

are two distinct structures in the penis, the **Corpora Cavernosa** and the **Corpus Spongiosum**. The corpora cavernosa lies on the under side of the organ between the two corpora cavernosa. The urethra runs through the penis and terminates at the urethral orifice in the **Meatus Urinarius**. The penis is well supplied with blood vessels and with nerves.

The Testes. The testes are the organs which secrete the seminal fluid. They occur in pairs and are enclosed in a sack called the scrotum. From each testicle leads a small tube through which the seminal fluid is conducted. This fluid is taken by these tubes to the seminal vesicles and from there reaches the exterior of the body by means of the urethra.

The Vagina. This curved canal extends from the female womb to the exterior of the body. It is about $2\frac{1}{2}$ inches long on its upper wall and about $3\frac{1}{2}$ inches long on its posterior wall. It is well supplied with nerves and blood vessels.

The Uterus. The uterus or womb is a pear shaped organ about 3 inches long and two inches broad. It is in this sack that the embryo is carried. The womb is connected with the ovaries by means of two tubes called the **Fallopian Tubes**. The ova travel down these Fallopian Tubes to reach the uterus.

QUIZ ON ANATOMY.

1. Define anatomy.
2. Name five subdivisions of anatomy.
3. What is syndesmology?
4. What is splanchnology?
5. Where is the incus located?
6. Where are the patella located?
7. What is amphiarthrosis?
8. What are fasciculi?
9. What is the endomysium?
10. What are sarcostyles?
11. What are aponeuroses?
12. What is the myocardium?
13. What is the pericardium?
14. What are the chordae tendineae?
15. What are the columnae carnae?
16. Describe the structure of an artery.
17. Describe the structure of a vein.
18. What are the capillaries?
19. What is the intima?
20. What is the adventitia?
21. What is the dura mater?
22. What is the pia mater?
23. How many pair of cranial nerves are there?
24. How many pair of spinal nerves are there?
25. Describe the mucous membrane.
26. What is the colon?
27. What are the fallopian tubes?
28. What is the corpora cavernosa?

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